



CLIMATE PROGRAM OFFICE

Global Carbon Cycle Program

Will the carbon cycle continue to function in predictable ways with significantly increased carbon dioxide concentrations in the atmosphere and ocean?

How will the carbon cycle respond to possible human interventions to manage it?

The Global Carbon Cycle (GCC) Program supports studies to quantify the magnitude and dynamics of the carbon cycle around the planet and to improve predictions about future levels of atmospheric carbon dioxide. The program also has a developing emphasis on determining how increased carbon dioxide levels in the atmosphere and ocean will impact ecosystems.

GCC Objectives

- Identify the location, magnitude, and dynamics of carbon sources and carbon sinks—situations where carbon is absorbed from the atmosphere—around the world, with a focus on carbon sinks in the Northern Hemisphere and the Southern Ocean.
- Investigate causes of variability in carbon sources and sinks.
- Improve predictability of future atmospheric carbon dioxide concentrations through better understanding of processes and better modeling.
- Determine the potential impacts of projected increases in atmospheric and oceanic carbon dioxide on ecosystems.



NOAA's Pacific Marine Environmental Laboratory and partners launch a buoy to measure air-sea exchanges of carbon dioxide, oxygen, and nitrogen gas. The buoy also measures the acidity of surface waters.

GCC Approaches

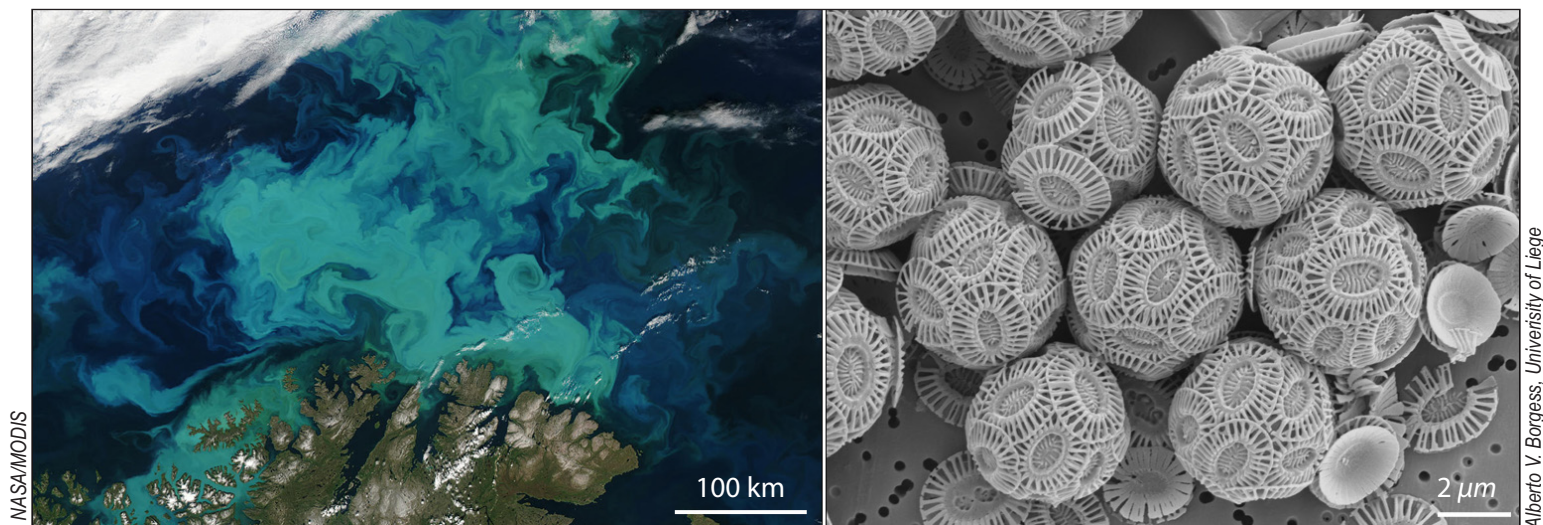
GCC supports projects that conduct studies on specific sources of uncertainty in the global carbon budget, improve data analysis and numerical modeling techniques involving carbon, and develop new instruments to enhance the capabilities and cost-effectiveness of NOAA's network of carbon observations. The goals of these projects are to:

- Determine the amount of atmospheric carbon dioxide currently being taken up by the ocean and how climate change will affect this process,

Global Carbon Cycle Program http://climate.noaa.gov/cpo_pa/gcc

Email: oar.cpo.gcc@noaa.gov

Macroscopic and Microscopic Views of One Component of the Carbon Cycle



Swirls of blue and green ocean water in this satellite view reveal a massive coccolithophore bloom. When conditions are just right, these microscopic marine plants multiply so profusely that they can be seen from space. The image on the right shows a microscopic view of the intricate structure of the shells of these tiny plants. Coccolithophores harness sunlight energy for photosynthesis and extract carbon dioxide from ocean water to build their shells of calcium carbonate. Increasing acidity of ocean water may disrupt the ability of these plants to grow by interfering with their ability to build shells.

Approaches (continued)

- Produce consistent analyses of North America's carbon budget and its year-to-year variability,
- Achieve quantitative understanding of the key biologic, geologic, chemical, and physical interactions and feedbacks between the ocean and the atmosphere.

The Carbon Cycle and Ocean Acidification

Ocean acidification may be one of the most significant and far-reaching consequences of the increase of carbon dioxide (CO_2) in the atmosphere. Some call ocean acidification the "other CO_2 problem," because, like global warming, it is driven by human-caused carbon dioxide. It is conceivable that acidification could change the ocean's basic food-web over the next 50 years. This rapidly emerging scientific issue and its potential for ecological impacts have raised serious concerns across the scientific and fisheries resource management communities. The GCC Program supports research to improve our fundamental understanding of the impacts of ocean acidification on ocean chemistry and ocean biology.

The GCC Program will also support research to perform scientific assessments of intentional manipulations of the carbon cycle. Reliable research is needed before commercial ventures implement plans to claim carbon credits through large-scale iron fertilization of the ocean.

GCC Highlight: CarbonTracker

CarbonTracker is a system that calculates carbon dioxide uptake and release at the Earth's surface over time. Developed at NOAA's Earth System Research Laboratory, the system uses observations and model results to estimate the quantities of carbon dioxide moving into and out of the atmosphere across North America and the rest of the world. The CarbonTracker tool provides global maps and animations of carbon dioxide concentrations in the atmosphere. These maps are validated to ensure consistency with observed patterns of carbon dioxide in the atmosphere. Policy makers, industry representatives, scientists, and members of the public can use CarbonTracker to visualize "carbon weather" and to help them make informed decisions regarding greenhouse gas levels in the atmosphere.

U.S. Carbon Cycle Science Plan

GCC is working with carbon cycle researchers to review and set NOAA's carbon cycle research priorities for the future. The program aims to coordinate research, monitoring, and data management activities among national and international programs. The national priorities for carbon cycle research over the past several years have been strongly influenced by *A U.S. Carbon Cycle Science Plan*, but this plan is nearly ten years old. To address this issue, the Carbon Cycle Interagency Working Group has established a working group to develop a new science plan for the 2010-2020 timeframe.